TA Tips for Success in Lab

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Upload Two Files After Every Lab Challenge

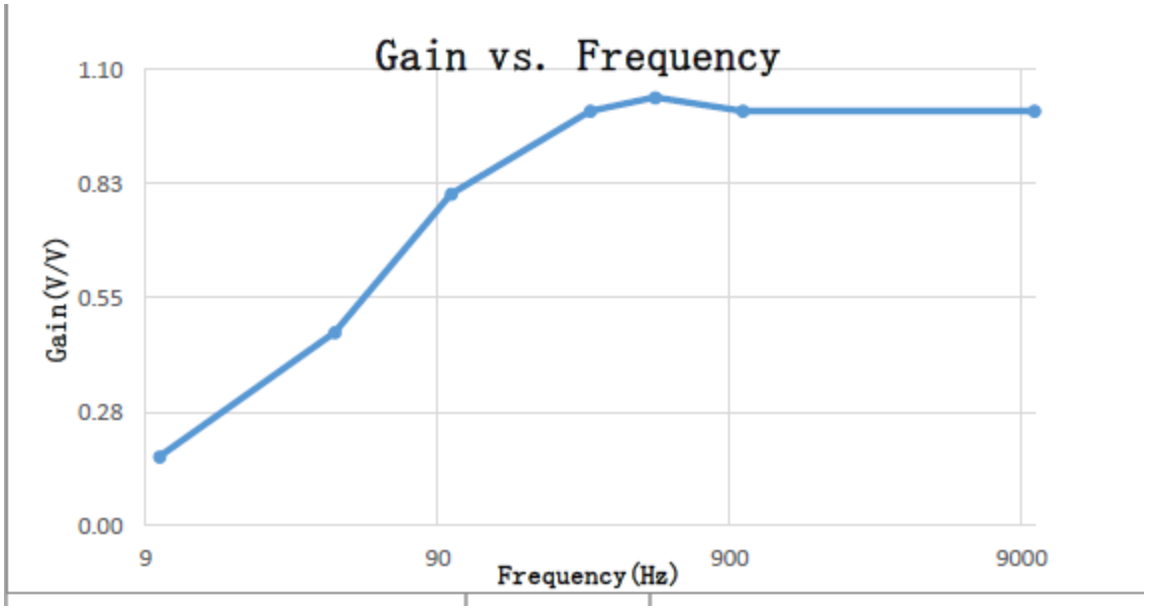
- **Excel Spreadsheet (.xlsx)**
  - **Raw data, plots**
- **Challenge Report (.pdf)**
  - **Clear documentation of your procedure, working notes**
  - **List of equipment**
  - **Imagine you are a year out from now, and these notes were all you had, you should be able to know what had occurred from what is written.**
  - **In other words, someone has never done the lab before should be able to replicate the lab by looking at your working notes.**

Frequent Occurred Problems with Excel Spreadsheet Documentation

- Plots
- Page View
- Corrupted File

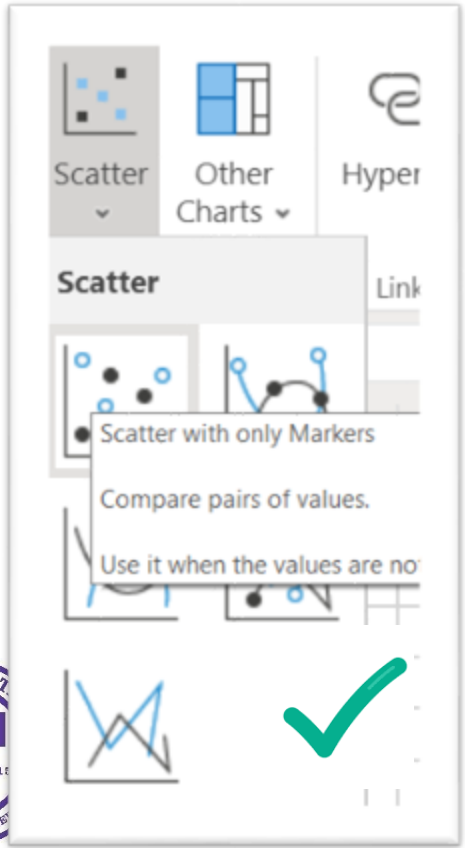
Frequent Occurred Problems with Excel Spreadsheet Documentation

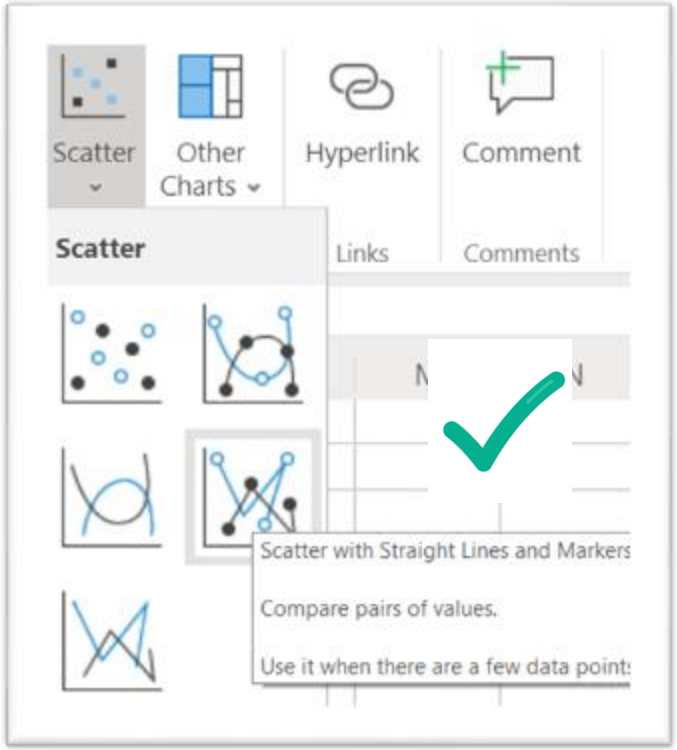
- **Plots**
  - **Label the plot (Y vs. X)**
  - **Axis**
    - **Scale (log scale, semi-log scale)**
    - **Label the axis**
    - **Units for each axis**

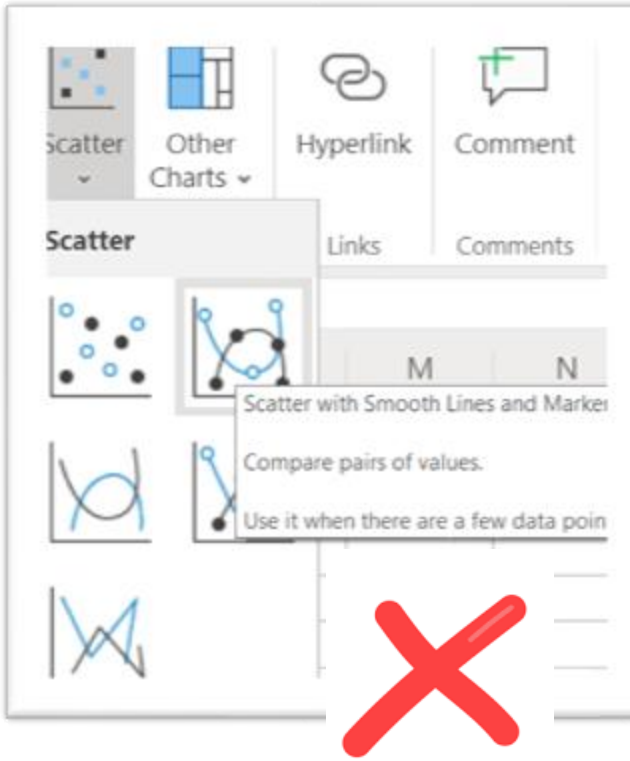


Frequent Occurred Problems with Excel Spreadsheet Documentation

- **Plots**
  - **Use scatter plot**
    - Scatter with only markers and Scatter with straight lines and markers is recommended
    - Do not use scatter with smooth lines







Excel Spreadsheet Documentation

- Page View
  - Bad Example

Activity 1			
Waveform Amplitude (Vpk)	Time Period for 5 Cycles (ms)	RMS Voltage (V_rms) (V)	Waveform Frequency (f) (Hz)
1.475	28.000	1.043	0.179

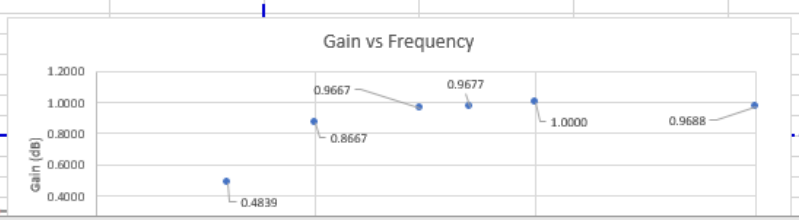
voltage calculated using observed waveform amplitude as described in working r
eform Frequency calculated using time period for 5 full capacitor time constant cy

Activity 2	
Amplitude (V_AC) (V)	Frequency (F) (Hz)
1.007	0.019

Very high variation in both observed amplitdue and frequency between the oscilliscope used in activity 1 and multimeter used in activity 2. Potential and suggested causations discussed in working notes alongside activity 3.

Activity 3									
Frequency of Input Signal f (Hz)	Magnitdue of Filtered Signal,	Channel 1 Time (Input) (sec)	Channel 2 Time (Output) (sec)	Time Shift Δt (sec)	Period T (sec)	Channel 1 (V_in) (V)	Channel 2 (V_out) (V)	Gain G (V_out/V_in)	Phase shift (deg) (Δt/T) x 360°
10,000	4.960	0.00003	0.00003	0.000001	0.0001	2.560	2.480	0.9688	3.600
1000	4.880	0.00008	0.00008	0.000002	0.0010	2.480	2.480	1.0000	0.720
500	4.800	0.00088	0.00100	0.000120	0.0020	2.480	2.400	0.9677	21.600
300	4.720	0.00162	0.00164	0.000020	0.0033	2.400	2.320	0.9667	2.160
100	4.000	0.00112	0.00114	0.000020	0.0100	2.400	2.080	0.8667	0.720
40	2.400	0.00048	0.00050	0.000020	0.0250	2.480	1.200	0.4839	0.288
10	0.608	0.00280	0.02080	0.018000	0.1000	2.080	0.304	0.1462	64.800

Code Annotations	Time shift calculated as difference bewteen input time recorded on channel 1 and output time recorded on channel 2.
	Period calculated from taking inverse of a known frequency.
	culated from the ratio of output voltage measured on channel 2 to the input voltage measured on channel 1 from a given fre
	Resulting phase shift calculated from ratio of time shift to determined period of a given frequency converted to degrees.
Comments	Presented findings of set of time shifts asscoaited with a given frequnecy input represent poor ability of laboratory personnel to sufficiently observe and approximate data using cusor bands features of a function generator. Increasing scale of image did little to increase success of performing adequate readings and considerably worsened ability of personnel to draw accurate conclusions regarding phase shifts associated with a high-pass dampening capacitor
	With the exception of the voltage readings taken for 1000 hz, gain calculations determined to be adequate for moderately dadmpened systems over a wide range of frequencies. Concluded to not be a notable source of inacurracy for this



Sheet1

Bad Example

Activity 1

Waveform Amplitude (Vpk) (V)	Time Period for 5 Cycles (ms)	RMS Voltage (V_rms) (V)
1.475	28.000	1.043

RMS voltage calculated using observed waveform amplitude or desc
Waveform Frequency calculated using time period for 5 full capacita

Frequency of Input Signal f (Hz)	Magnitude of Filtered Signal	Channel 1 Time (Input) (sec)
10,000	4.960	0.00003
1000	4.880	0.00008
500	4.800	0.00088
300	4.720	0.00162
100	4.000	0.00112
40	2.400	0.00048
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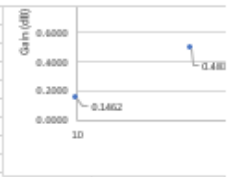

Activity 2

Waveform Frequency (f) (Hz)
0.179

cribed in working note
ar time constant cycle

Amplitude (V_AC) (V)	Frequency (F) (Hz)
1.007	0.019

Activity 3

Channel 2 Time (Output) (sec)	Time Shift Δt (sec)	Period T (sec)	Channel 1 (V_in) (V)
0.00003	0.000001	0.0001	2.560
0.00008	0.000002	0.0010	2.480
0.00100	0.000120	0.0020	2.480
0.00164	0.000020	0.0033	2.400
0.00114	0.000020	0.0100	2.400
0.00050	0.000020	0.0250	2.480
0.02080	0.018000	0.1000	2.080

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ings taken for 1000 hz, gain calculations determined to be adequate for moderately
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Very high variation in both observed amplitude and frequency between the oscilliscope used in activity 1 and multimeter used in activity 2. Potential and suggested causations discussed in working notes alongside activity 3.

Channel 2 (V_out) (V)	Gain G (V_out/V_in)	Phase shift (deg) (Δt/T) x 360°
2.480	0.9688	3.600
2.480	1.0000	0.720
2.400	0.9677	21.600
2.320	0.9667	2.160
2.080	0.8667	0.720
1.200	0.4839	0.288
0.304	0.1462	64.800

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Good Example

Challenge 3

Activity 1

Waveform amplitude: Vpk = 1.50 V	Time Period for 5 cycles: $T_{5cycles}$ = 20.5ms
RMS Voltage: Vrms = 1.06V	Waveform frequency: f = 244 Hz
6	Cyc RMS: 1.08 V
Freq: 239.5 Hz	Period: 4.175 ms

Activity 2

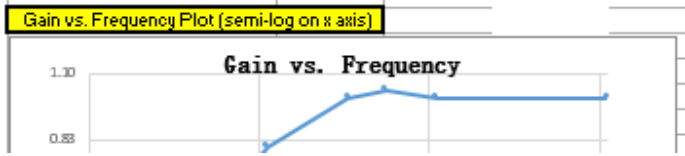
Amplitude, VAC: 1.044V	Frequency, F: 240.3Hz

Activity 3

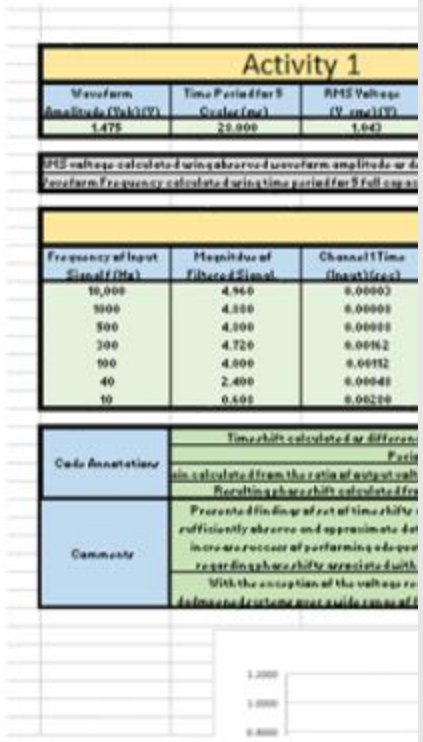
Frequency f (Hz)	M of Filtered signal Vpk-	Time Shift Delta t (s)	Period T(s)	Gain G (Vout/Vin)	Phase Shift	Vin	Vout
10000	5.04	0	0.0001	1.00	0.0	2.4	2.4
1000	4.88	0	0.001	1.00	0.0	2.32	2.32
500	4.72	0	0.002	1.03	0.0	2.4	2.48
300	4.72	0.0000002	0.003	1.00	0.0	2.32	2.32
100	.76	0.001240	0.01	0.80	44.6	2.4	1.92
40	.24	0.005	0.025	0.47	72.0	2.4	1.12
10	0.552	0.032	0.1	0.17	115.2	1.92	0.32

1

Gain vs. Frequency Plot (semi-log on x axis)



The Difference



Challenge 3

Activity 1

Waveform amplitude: Vpk = 1.50 V

Time Period for 5 cycles: $T_{5\ cycles}$ = 20.5ms

RMS Voltage: Vrms = 1.06V

Waveform frequency: f = 244 Hz

6

Freq: 239.5 Hz

Cyc RMS: 1.08 V

Period: 4.175 ms

Activity 2

Amplitude, VAC: 1.044V

Frequency, F: 240.3Hz

Activity 3

Frequency f (Hz)	M of Filtered signal Vpk-	Time Shift Delta t (s)	Period T(s)	Gain G (Vout/Vin)	Phase Shift	Vin	Vout
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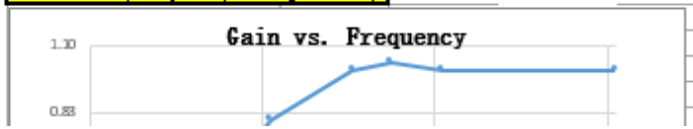
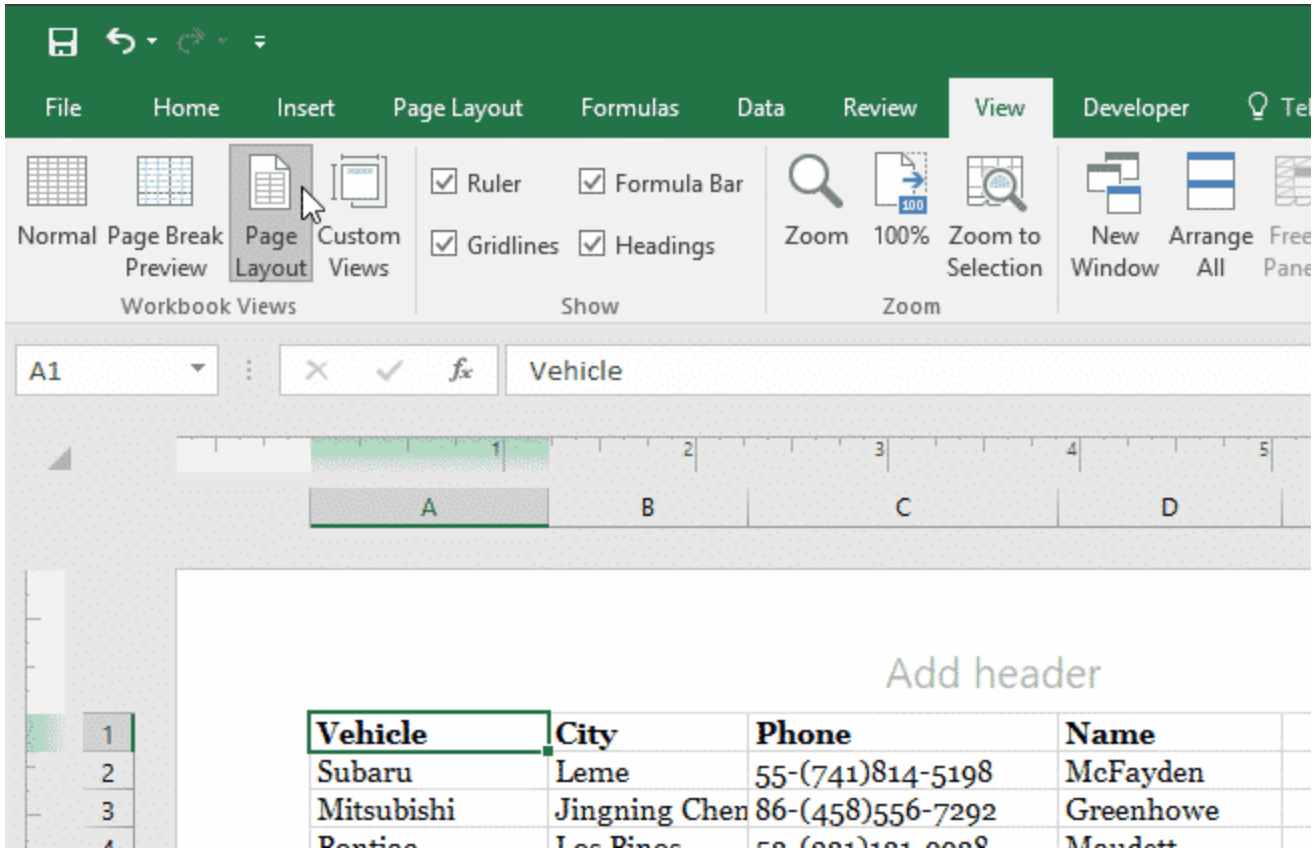


Excel Spreadsheet Documentation

- **How to setup Page View**
  - **View > Page Layout**



Challenge Report Documentation

- List of equipments
- Labeled with number
- Clear documentation of procedure
- Following is a good example and a bad example

Good example and bad example, what's the difference?

➢ Good Example

Challenge 4 Working Notes

Equipment used:

1. B – 102 Stain Gage with following properties

2. Model P-3500 Digital Strain Indicator
3. Beam Bending Fixture (for wire extension)

4. C-clamp and aluminum block
5. Brass slotted weight set and hanger

➢ Bad Example

Challenge 4 Working Notes

Equipment used:

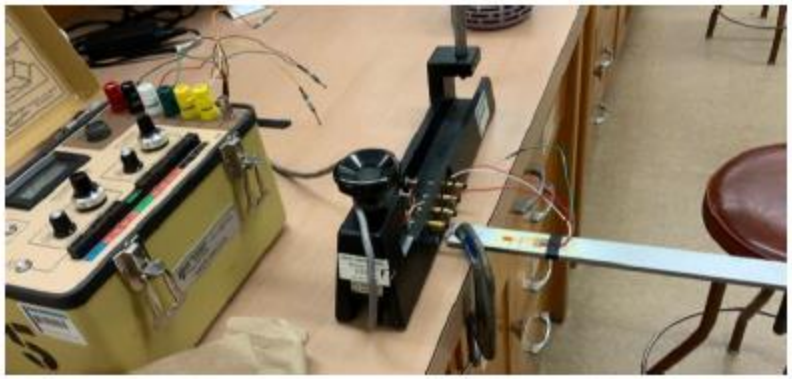
1. Stain Gage
2. Strain Indicator
3. Beam Bending Fixture (for wire extension)

- Didn't list all the equipment used
- No detailed description of which equipment is used
- No picture of which equipment is used
- *If you are to replicate the lab, which working notes is easier to follow?*

Good example and bad example, what's the difference?

➢ Good Example

The setup:



➢ Bad Example

No drawing or picture of the setup

- *If you are to replicate the lab, which working notes is easier to follow?*

Good example and bad example, what's the difference?

➢ Good Example

Activity 1: Setup

Table 1 - Beam Dimensions

Beam Width, b (in)	Beam Thickness, h (in)	Moment Arm Length, L (in)
1.001	0.249	10 5/16

Note: Beam Width & Beam Thickness are measured with a Vernier Caliper, with an uncertainty of 0.0005 inch. The Moment Arm Length is measured with a ruler, with an uncertainty of 1/32 inch.

➢ Bad Example

Activity 1: Setup

Table 1 - Beam Dimensions

Beam Width, b (in)	Beam Thickness, h (in)	Moment Arm Length, L (in)
1.001	0.249	10 5/16

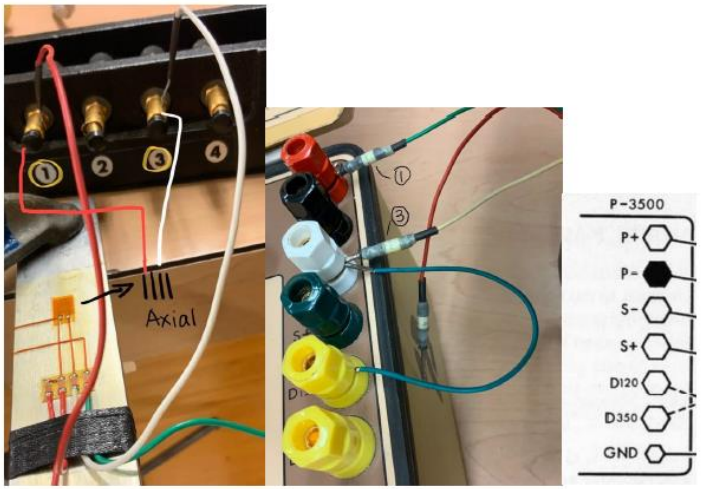
- No description or indication of uncertainty
- *If you are to replicate the lab, which working notes is easier to follow?*

Good example and bad example, what's the difference?

➢ Good Example

Activity 2: Strain Gage Connection - Axial

Wiring:



Since the white wire is connected to the axial gage, I connected it with the terminal 3 of the secondary fixture. Then I looked for wires labeled as #1 and #3 in the pig tail. According to the quarter bridge arrangement, I connect #1 to the P+ terminal (red), #3 to the S- terminal, then I add a wire between S- and D120.

Then I followed steps 1-5 listed on the lid of the P-3500 unit.

➢ Bad Example

No drawing or picture of activity 2

- *If you are to replicate the lab, which working notes is easier to follow?*

Good example and bad example, what's the difference?

Good Example

Activity 3 & 4: Loading the Beam & Strain Gage Connection - Transverse

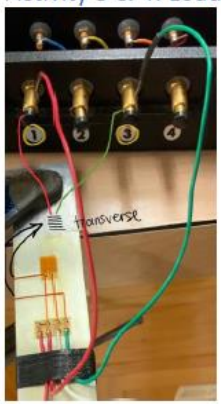


Table 2 - Strain Gage Readings

Number of Bolts	Total Bolt Weight(s) (lbf)	Axial Gage Strain Reading, ε_a (με)	Transverse Gage Strain Reading, ε_t (με)		Bending Stress (psi) *calculated*	Poisson's Ratio, ν *calculated*
1	0.551	54	-17		549	0.31481
2	1.10	108	-34		1097	0.31481
3	1.65	161	-51		1645	0.31677
4	2.21	214	-67		2203	0.31308
				Average ν:		0.31487

The brass weights of 250g, 500g, 750g and 1000g is used.
I switched the white wire to the green wire, which connects to the transverse gage. The reading was shown positive but because it's on the other side of the beam, it's actually negative with respect to the axial gage.

Bad Example

Activity 2, 3 & 4: Loading the Beam & Strain Gage Connection - Transverse

Table 2 - Strain Gage Readings

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3	1.65	161	-51		1645	0.31677
4	2.21	214	-67		2203	0.31308
				Average ν:		0.31487

- No documentation of the procedure, no picture or drawing of the wiring
- *If you are to replicate the lab, which working notes is easier to follow?*

Good example and bad example, what's the difference?

➢ Good Example

Calculations

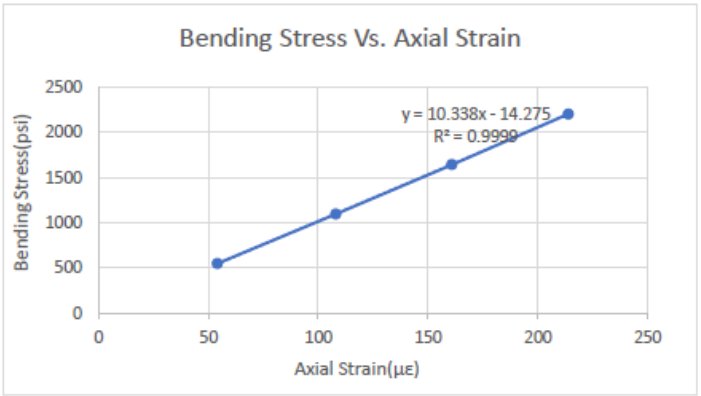
The Bending Moment is calculated using the equation $M = F L$. In which F is the total weights in lbf, L is the measured Moment Arm Length with a ruler.

M(lbf*in)
5.68
11.3
17.0
22.8

The Bending Stress on a Surface is calculated using the equation $\sigma = M c / I$ (c = distance from the neutral axis to the surface = $h/2$). In which I is calculated using $I = b h^3 / 12$. The b is the measured beam width and beam thickness with a Vernier Caliper.

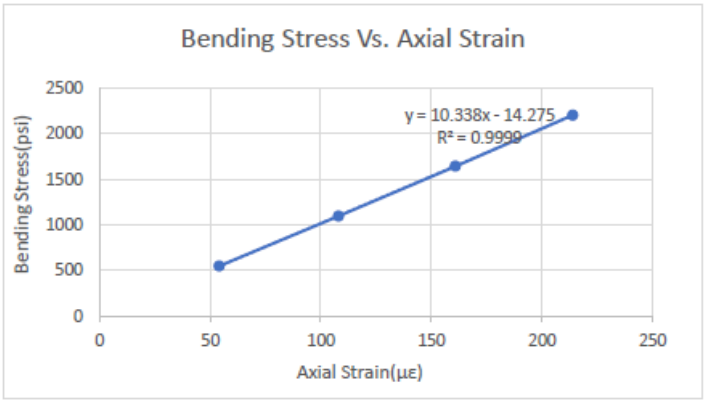
I(in^4)
0.00129
0.00129
0.00129
0.00129

Then, the Poisson's Ratio is calculated using the equation $\nu = -\varepsilon_t / \varepsilon_a$.
The plot of the stress-strain is plotted as follows:



The Modulus of Elasticity is the slope of the linear fitting, 10Mpsi (Aluminum).

➢ Bad Example



The Modulus of Elasticity is the slope of the linear fitting, 10Mpsi (Aluminum).

- No calculation process shown, (either handwritten or typed) only shows the plot
- *If you are to replicate the lab, which working notes is easier to follow?*

Questions

Thanks for your attention and time!